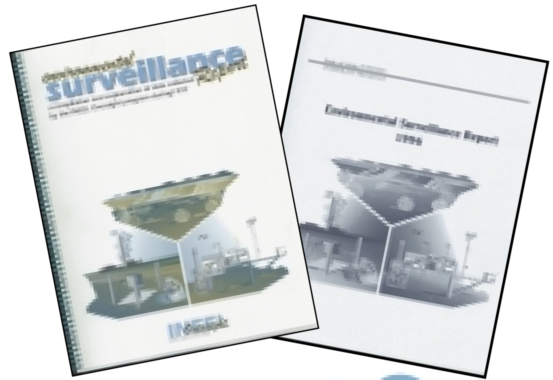
How does the INEEL affect Idaho's Environment?



Monitoring is the backbone of Oversight's efforts to independently assess activities at the INEEL on behalf of the citizens of Idaho.

We're one of four organizations that monitor the environment on and around the site. Each organization uses slightly different methods and checks different places. Nevertheless, a comparison of the results garnered by each program is an important quality check. If the results are similar, it affirms their accuracy. If they differ, steps can be taken to find out why.

Oversight's monitoring program has two complementary components: environmental surveillance and community monitoring. The key difference in these two programs is how data are provided.

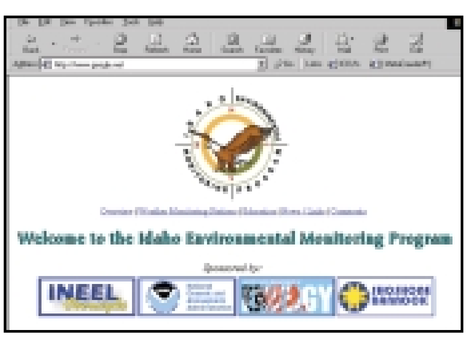
The Environmental Surveillance Program, referred to as ESP, has been part of Oversight since the program's inception. Reports are issued annually and quarterly. Annual reports include comparisons to data collected by other organizations and analysis of trends. Quarterly reports include the most recent data collected, with little discussion. Both types of reports are mailed to people who request them and are posted on our web site at http://oversite.inel.gov/deqinel/. You can see these reports on line or download an Adobe Portable Document Format (PDF) file.

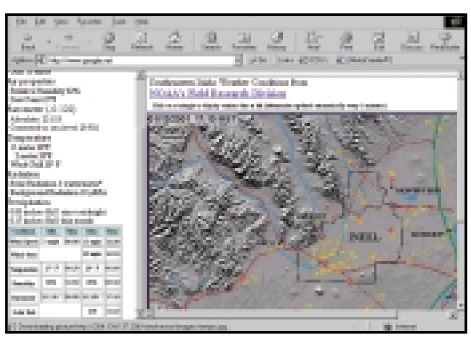
Above, a community monitoring program kiosk. Below, features of the program's web site: the home page, a live map showing wind direction and speed, and one of the program's pages developed for teachers and students.

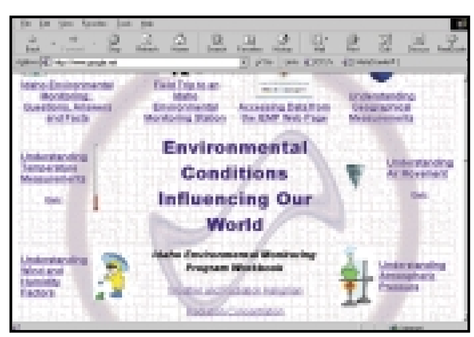
Some ESP data is available on our web site. We're working to make more data available through that medium, and provide information that will help you make sense of the data we post.

Community Monitoring, a partnership with DOE, the National Oceanic and Atmospheric Administration, the City of Idaho Falls, and the Shoshone-Bannock Tribes, is a relatively new part of Oversight's monitoring activities.

Information is collected at stations on and around INEEL, and displayed "live" at kiosks in local communities and at the Lost River Rest Area, which is on the INEEL near Arco. The data are also on the internet at http://versite.inel.gov. It is updated every five minutes.







Monitoring offsite shows no effects from INEEL

“Our goal is simple: provide the best possible information to policy-makers and the public.”

Oversight’s environmental monitoring program indicates there are no offsite public health impacts from ongoing INEEL activities. Radiological air measurements from onsite indicate INEEL meets—and is indeed well below—standards established to protect public health and the environment. Gamma radiation measurements on and around the site are consistent with naturally occurring “background” radiation levels. However, some areas of soil and groundwater on and beneath the INEEL from historic waste disposal practices are above health standards. These areas are being addressed by Superfund-style cleanup by EPA, DOE, and Idaho’s DEQ.

Oversight’s 1999 results are similar to those of other organizations that monitor on and around the site: the U.S. Geological Survey, the Environmental Science and Research Foundation, and BBWI, the contractor that runs the site for DOE.

“These results should lend confidence to the citizens of Idaho on two fronts” says Oversight scientist Kristi Moser. “First, Oversight results show that the facility’s effects on the environment were confined to the site in 1999. Second, all of these programs came up with the same conclusions. It shows that each program is doing good work.”

Moser is responsible for Oversight’s Quality Assurance and Quality Control efforts. Called QA/QC, these are the checks and double-checks all monitoring data go through before being considered final.

Many things can go wrong and lead to inaccurate data: instruments may not be calibrated or read correctly; samples may be mislabeled or contaminated after they are drawn; one anomalous reading may be taken as representative; or samples may be mishandled.

A good QA/QC program anticipates, addresses, and therefore minimizes such problems. Although measurement of any physical or chemical quantity is subject to uncertainty, Oversight’s quality assurance and control system ensures that data collection and analysis are as consistent and accurate as possible.

One common component of quality control is duplication: if more than one sample from the same site yield similar values, the results are more reliable than those of a single sampling. The fact that four different organizations monitor the INEEL’s effects on the environment provides a considerable measure of quality control.

If all four sets of results concur—as the Environmental Surveillance Reports indicate they generally do—then their scientific validity is reinforced. This should increase public confidence in those results.

Of course, INEEL’s contractor might be perceived as biased and hence lacking scientific objectivity. Oversight is an independent scientific organization. Our goal is simple: provide the best possible information to policy-makers and the public.

We know that the environmental data collected on and around INEEL is crucial to decisions involving protection of the Snake River Aquifer and those whose livelihoods depend on it. That’s why Oversight was created, and it’s still our core mission.

So it’s reassuring that Oversight’s Environmental Surveillance Program concludes that INEEL activities pose no significant offsite threat at this time to Idaho’s environment or citizens.

That’s the kind of quality assurance we can all appreciate!

Quality assurance and quality control procedures apply to every step of the monitoring process, from locating monitoring sites...

to collecting samples in the field...

through taking samples to the laboratory and testing them. They even apply to the methods we use to report data, so we’ll be consistent and accurate.

Guide to contaminants monitored by Oversight

Light is one of many types of energy called electromagnetic radiation. This type of energy travels in waves which vary in frequency and length. These variations are used to categorize electromagnetic radiation into the electromagnetic spectrum.

*Visible light is in the middle of the spectrum. At the bottom end are radio waves, and at the top is **gamma radiation**. Gamma radiation has high-frequency, short-length waves.*

Common ions and nutrients, measured in water samples, are naturally occurring elements and compounds that make up ninety-nine percent of all dissolved constituents in ground water or surface water. These include calcium, magnesium, sodium, potassium, chloride, fluoride, sulfate, nitrate, phosphorus, and dissolved carbon dioxide. These common ions and nutrients also make up the vast majority by weight of dissolved contaminants disposed of in waste water at INEEL. Together, these ions allow an assessment of the overall health of the groundwater.

Trace metals, measured in water samples, are those metallic elements that are present at very low concentrations in groundwater. These elements also appear naturally, but at very low levels. Some of these, such as chromium, zinc, and barium were also disposed in INEEL wastewater.

Gross alpha and beta radioactivity is monitored for in air and water. It can be natural or man-made. The test for these types of radioactivity is a screening test, measuring contaminants or naturally occurring radionuclides that emit alpha and beta radiation. If measured radioactivity exceeds expected background levels, then further analyses are done to find specific radioactive isotopes.

Gamma-emitting radionuclides are monitored for in air, precipitation, water, soil, and milk by examining the spectrum of gamma radiation given off by a sample. This spectrum is like the spectrum of light we see when light passes through a prism. **Cesium-137, Iodine-131,** and naturally occurring **Potassium-40** are several of the isotopes identified by their unique gamma-radiation energies.

Tritium is monitored for in precipitation, water vapor in the air, and water. Tritium is a radioactive isotope of hydrogen that is most often found taking the place of nonradioactive atoms in water molecules. It is made naturally in the atmosphere and it can be created in nuclear accelerators or reactors. It is present in spent nuclear fuel.
Tritium gives off a low-energy beta particle and is not seen in a gross beta analysis.

Strontium-90, monitored for in selected water and air samples, is one of the many isotopes created when uranium or plutonium is fissioned in a reactor. It decays with beta radiation.

Technicium-99 is monitored for in selected water samples. This isotope is produced only in nuclear reactors and was released when wastewater was disposed of in ponds or wells. Technicium-99 decays with beta radioactivity.

Transuranic radionuclides have more protons in their nuclei than uranium. They are created in a nuclear reactor as a result of nuclear fission. Transuranic radionuclides are monitored for as particles captured on air filters. We also look for them dissolved in groundwater. **Plutonium and americium** [pronounced am-er reese-e-um] are among the specific transuranic radionuclides we monitor for. Transuranic elements emit alpha-particle radioactivity and may also be seen with screening for alpha radioactivity or by gamma-spectroscopy analysis.

Iodine-129 and Chlorine-36 are monitored for in groundwater. They are radioisotopes that occur naturally at very low levels, but were also produced during worldwide nuclear weapons testing. These isotopes are also characteristic of INEEL wastewater, and travel quickly with groundwater. These isotopes, which we test for only as part of special studies, are generally present at very low levels (to a million times lower than drinking water standards) and require special testing methods to see them at these atoms-per-liter levels.

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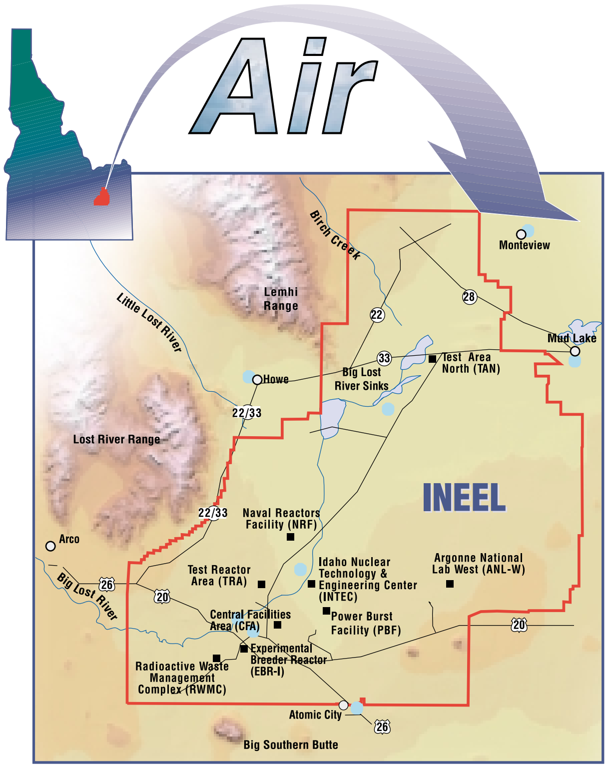


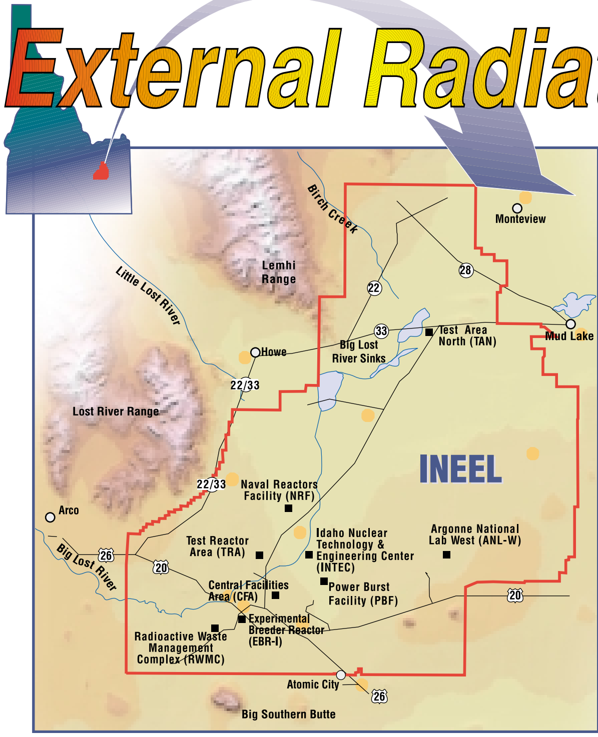
Small radioactive particles can be carried in the air we breathe. Oversight's Environmental Surveillance Program has established a network of ten air monitoring stations to verify radioactive air emissions from INEEL activities do not pose a health threat.

These stations are located on the site, around the site, and down and upwind from the site. They're equipped with instruments which collect particulates, precipitation, radioactive iodine, and water vapor. Analysis of these samples in 1999 indicated no offsite environmental impacts from INEEL operations.

Elevated tritium concentrations in atmospheric moisture were observed at onsite locations at times, but not at levels approaching regulatory limits. Data collected by the other monitoring agencies generally correlate well with Oversight's. Discrepancies, which were slight, have been traced to differences in sampling methods.

Contaminant	Results of 1999 air monitoring
Gross alpha radiation	Airborne particulates are screened for alpha particles. Elevated levels were seen during the last two weeks of 1999 at all monitoring sites. Oversight attributes these elevated levels to radon and radon decay products, produced naturally by the earth, being "trapped" near the ground by temperature inversions which occurred during that time. Measurements throughout the rest of the year were consistent with historical background measurements.
Gross beta radiation	Airborne particulates are screened for beta particles. Elevated levels were seen during the last two weeks of 1999 at all monitoring sites. Oversight attributes these elevated levels to radon and radon decay products, produced naturally by the earth, being "trapped" near the ground by temperature inversions which occurred during that time. Measurements throughout the rest of the year were consistent with historical background measurements.
Radioactive iodine	No radioiodines, including Iodine-131, have ever been observed.
Gamma radiation	Filters collected weekly are also combined into quarterly composites by location. Weekly filters and composites are analyzed using gamma spectroscopy, a process through which a spectrogram (record of the spectrum) is made and analyzed for signature energies of specific isotopes. No man-made radionuclides were observed in 1999. Samples of precipitation are also analyzed through gamma spectroscopy. No man-made radionuclides were identified in precipitation samples collected in 1999.
Manmade radionuclides	Filters collected weekly are also combined into annual composites by location. Weekly filters and composites are analyzed for Strontium-90, Americium-241, Plutonium-238, and Plutonium-239/240 through sophisticated radiochemical separation. No man-made radionuclides were observed in 1999.
Tritium	Samples of precipitation and atmospheric moisture are collected and analyzed for tritium. Tritium was not detected in most of the samples taken in 1999, with several exceptions: small quantities of tritium were detected in samples of atmospheric moisture collected on the site and in Idaho Falls; and in samples of precipitation collected at the Atomic City monitoring station.

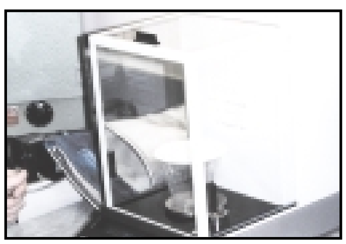
External Radiation



Oversight's network of 14 radiological monitoring stations checks radiation levels both on- and offsite. A combination of instruments measures natural cosmic and terrestrial sources so we can tell if radiation is emitted by sources at INEEL.

The *1999 Environmental Surveillance Report* found that radiation levels offsite were at or near background levels in all cases. Onsite radiation levels were well below the regulatory limits set to protect human health and the environment.

Oversight scientists continue to develop more rigorous estimates of naturally occurring "background" levels of radiation, so that INEEL's contribution to total radiation in the area can be estimated even more precisely.



Left: an air filter from a particulate sampler which pulls air through the filter. The filters are analyzed for the presence of radionuclides. Oversight uses a network of low-volume samplers for ongoing environmental surveillance, and activates a second network of high-volume when additional monitoring information is needed.

Right: An air filter being weighed in Oversight's laboratory. Filters are weighed before they are placed in samplers and after they are collected so we know how much the mass of the filter has changed.

Left: A device used to read initial and final voltages of electret ionization chambers, also called EICs or electrets. A disc in the electret is set with a specific electric charge. The disc loses a bit of its charge each time a gamma ray goes through it, so when the change is measured it tells how much gamma radiation the electret was exposed to.

Right: a tritium column filled with silica beads. When air is pulled through the column the beads absorb moisture. Analysis of the moisture from the beads gives us a measure of tritium in atmospheric moisture.

Contaminant	Results of 1999 external radiation monitoring
Gamma Radiation	Measurements were consistent with expected background levels. Pressurized ion chambers (one type of monitoring equipment) detected small seasonal changes that varied uniformly at each station and are relatively consistent from year to year. Because the quality of thermoluminescent dosimeter readings decreased, Oversight switched to electret ionization chambers for measuring gamma radiation. We also increased our monitoring coverage by using more electret ionization chambers than the dosimeters we used to use.

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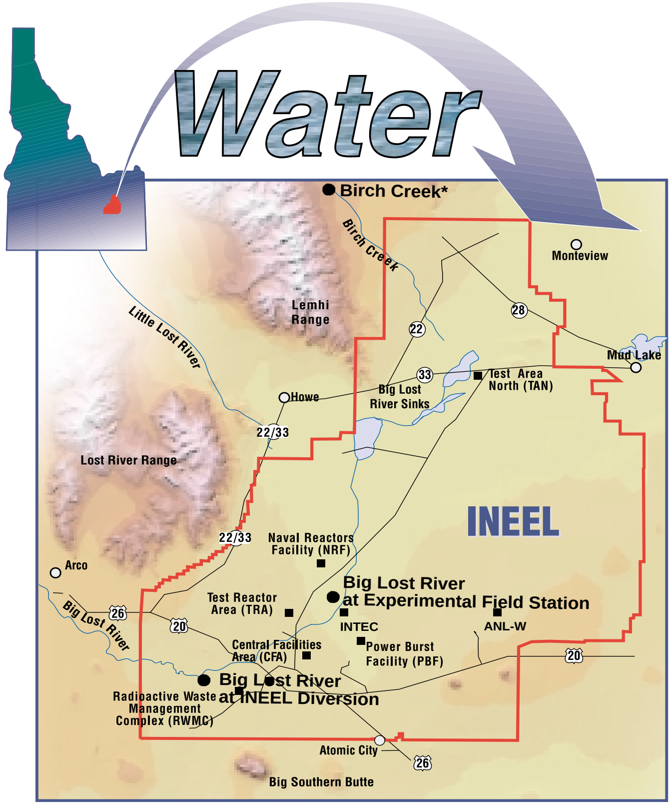
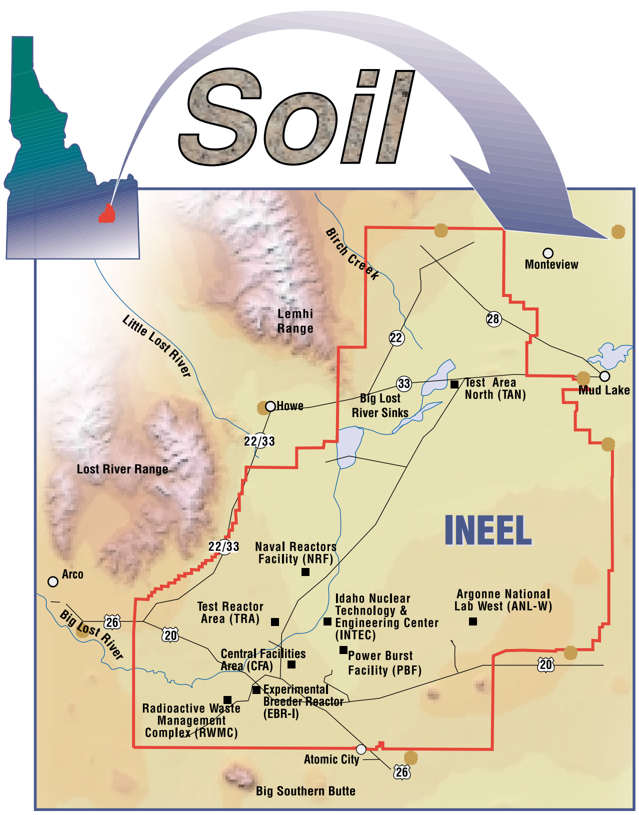


* *Birch Creek is sampled at Highway 28, about 15 miles north of the INEEL boundary.*

Streams are the arteries of an ecosystem, efficient means of transporting nutrients and contamination. Because they support such a wide range of beneficial uses, from drinking water to agriculture to recreation, surface waters are particularly valuable.

Concentrations of dissolved metals and nutrients were below background levels at all surface water sites. Although gross alpha radioactivity was detected at all surface water sites, its levels probably indicate naturally elevated radioactivity due to the presence of uranium and thorium in the landscape. Recharge from INEEL surface waters is not contributing to contamination of the aquifer, a measure of the relative cleanliness of current operations.



Should contamination from INEEL activities make its way into Idaho soil, uptake of contaminants could pose a threat to local farmers and consumers around the world. That's why Oversight collects soil samples from 14 monitoring sites, both at the facility borders and as far afield as Blackfoot and Carey.

There is some onsite contamination from past releases. It is being addressed by the ongoing cleanup program. Offsite sampling revealed no significant contamination from INEEL.

INEEL contractor soil monitoring results have been consistent with Oversight's.

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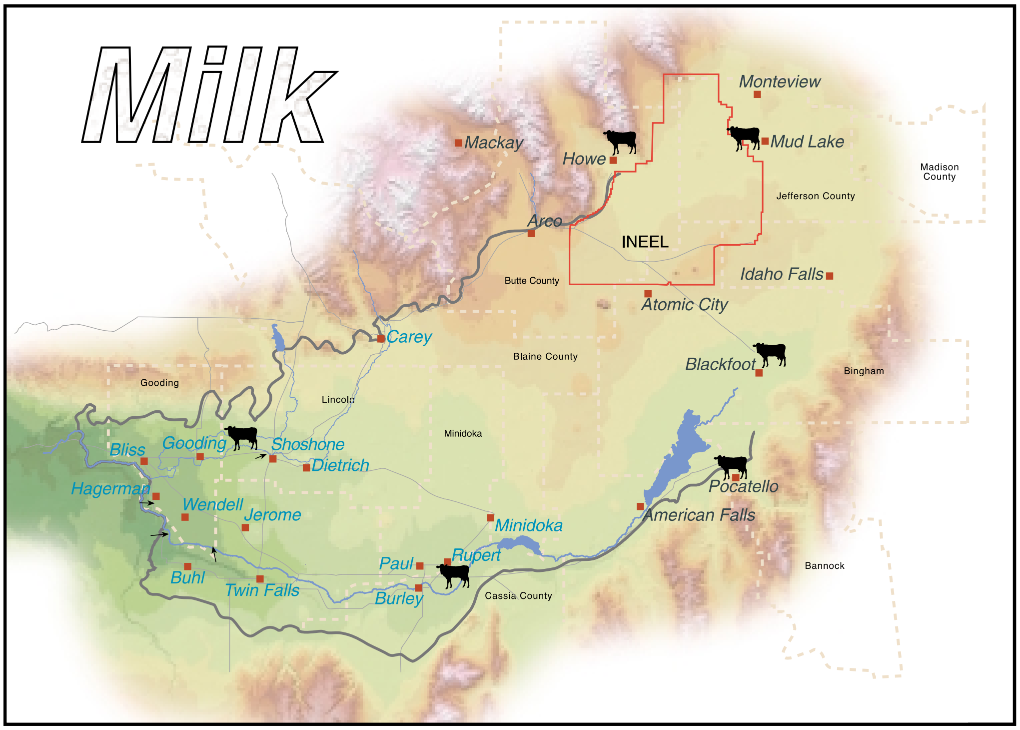

Milk does a body good—unless it's contaminated with radioactive iodine.

Since cows typically graze over large areas of pasture or range, and their milk tends to concentrate iodine, a relatively small level of radioactive fallout can translate into high concentrations in milk. Children probably absorb the highest doses of any radioactive iodine contamination. They generally drink more milk than adults, and their thyroid glands, where iodine concentrates in the human body, are smaller. Children are also often more sensitive to contaminants in their bodies than adults. That's why Oversight checks samples of milk from carefully selected dairies twelve times a year at six locations.

Fortunately, milk samples collected by Oversight from dairies both near the INEEL border and distant from the facility showed no elevated levels of radioactivity. Gamma spectroscopic analysis revealed Potassium-40 (a naturally occurring radionuclide found in bananas and potatoes as well as milk) and Iodine-131 at normal levels.

INEEL contractor milk monitoring results appear to corroborate these findings.

Contaminant	Results of 1999 milk monitoring
Radionuclides	Potassium-40 and Iodine -131 were found at background levels. Oversight has not detected any man-made radionuclides in milk.

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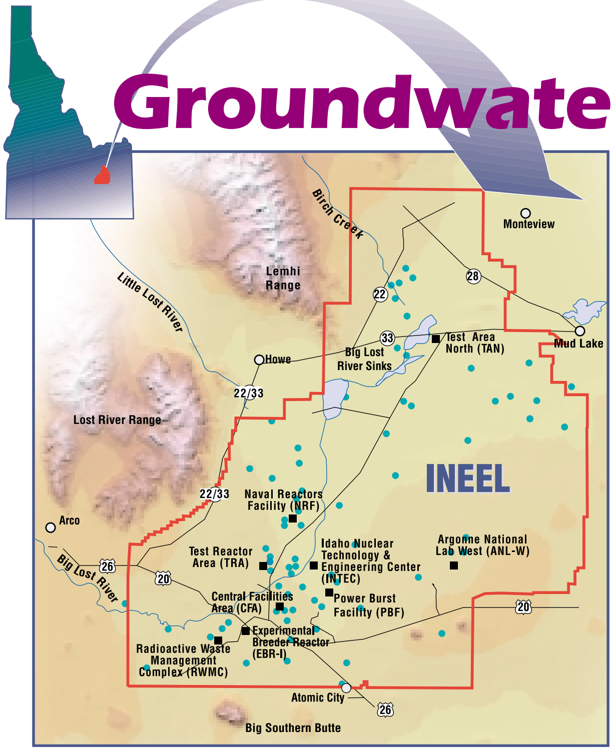
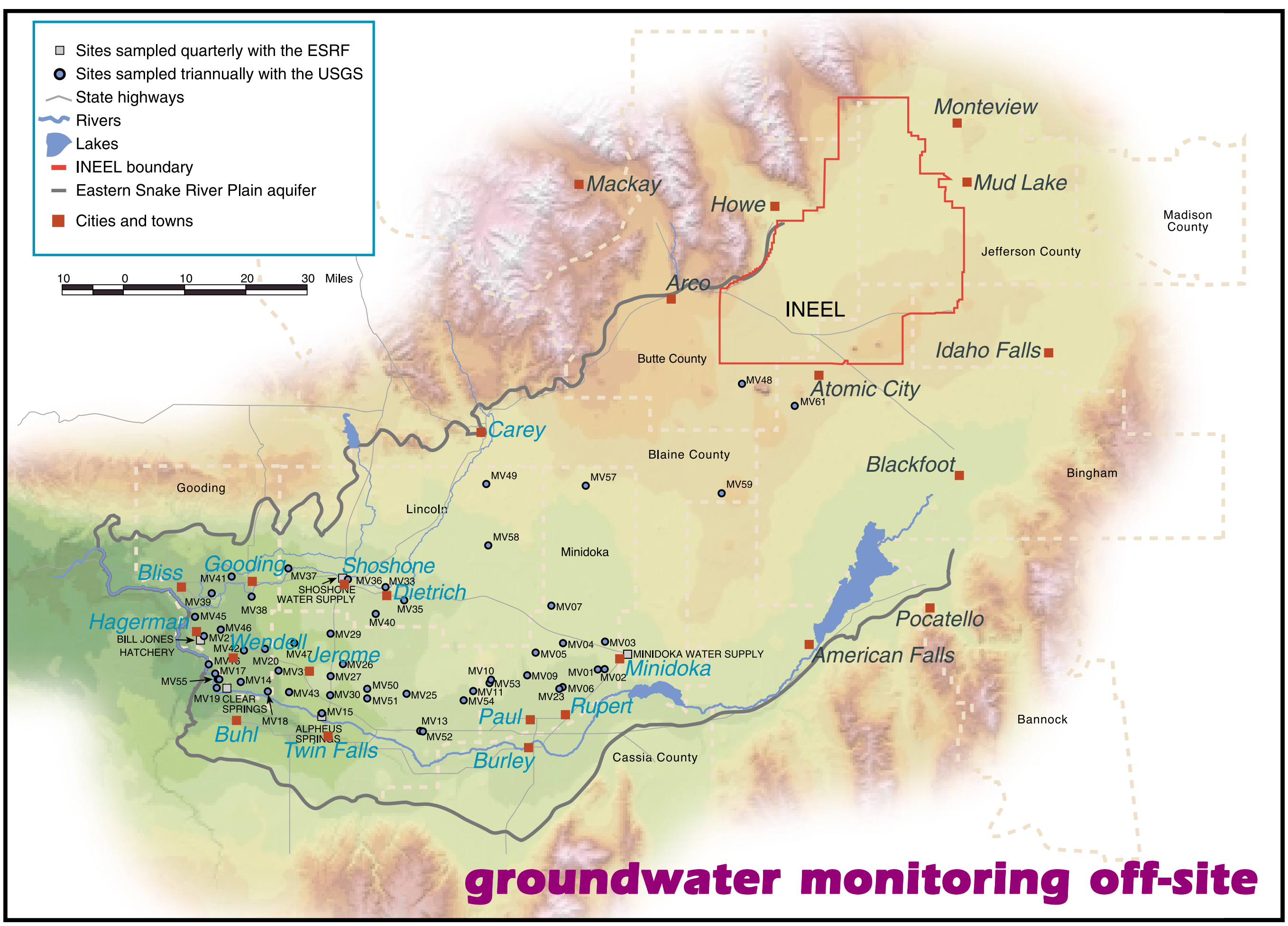
Groundwater



Oversight's Environmental Surveillance Program monitors groundwater quality at 97 sampling sites on and down-gradient from INEEL. We sample at a percentage of the hundreds of wells drilled by DOE or the USGS. We also sample 11 of INEEL's wastewater sites.

No contaminants have been found in the Magic Valley, but groundwater contamination does exist underneath the site. The state is concerned about these plumes, because the Eastern Snake River Plain Aquifer supplies most of the water that supports the Magic Valley's agricultural and aquacultural industries as well as the bulk of the region's drinking water. Further, groundwater is a particularly difficult medium to clean up.



groundwater monitoring off-site

The Eastern Snake River Plain Aquifer is huge in length, width, and depth. It has unique and unusual characteristics, like the Big Lost River that "disappears" into the high desert and the springs in the Thousand Springs area, where the River seems to magically reappear.

Volcanic activity created the layers of rocks, soil, and sand that make up the Snake River Plain which houses the aquifer. Groundwater and any contaminants that may be carried with it follow a torturous path through the highly fractured basalt and cinders, sometimes slowed or diverted by massive lava flows or buried soils.

It takes at least 150 to 250 years for water in the aquifer to travel from the area underneath the INEEL to Thousand Springs. Given what we now know about the nature and extent of the contamination and the cleanup activities being planned, investigated and carried out at the site, it's unlikely that much, if any contamination from INEEL will ever reach the Magic Valley. Contaminants that might survive to travel that far would be so diluted or would stick to rocks and buried soils such that they could only be found by extraordinarily sensitive methods of analysis or be indistinguishable from what occurs naturally.

Contaminant	**Results of 1999 groundwater monitoring**
Common Ions Nutrients Trace Metals	In areas of known groundwater contamination on INEEL, calcium, chloride, magnesium, nitrates, potassium, sodium, chromium and barium were found at levels above background. 1999 results were consistent with results reported by Oversight in past years. In general, concentrations of chloride, barium, and chromium have been decreasing downgradient from the Test Reactor Area and the Idaho Nuclear Technology and Engineering Center. Concentrations of chloride have dropped to background levels south of the Central Facilities Area. Barium has remained at background levels at the southern boundary of INEEL, but chromium levels have been slightly above background at these locations.
Gross Alpha Radioactivity	Gross alpha radioactivity was detected in more than one of every 3 samples for 1999, due to improved instruments which allow us to detect smaller concentrations of radiation. These measurements are consistent with background levels.
Gross Beta Radioactivity	In areas of known groundwater contamination south of the Idaho Nuclear Technology and Engineering Center (INTEC), gross beta radioactivity was detected in two wells (USGS 85 and USGS 112) at levels above background. Subsequent analyses determined that Strontium-90 was a significant source of gross beta radioactivity. Strontium-90 levels in one well, USGS 112, exceed drinking water standards.Sr-90 above the drinking water standard was detected in wells near the TAN injection well and in perched water at the TRA.
Gamma Radionuclides	No gamma-emitting radionuclides were detected in water samples collected by Oversight during 1999.
Tritium	Tritium from past waste disposal practices was detected at concentrations above or near the drinking water standard at several INEEL wells. Also, levels greater than expected from natural sources (the reaction of cosmic rays with nitrogen) were detected offsite at wells near the southern INEEL boundary. These levels are about 1% of the drinking water standard. Wells near the Test Reactor Area and the Idaho Nuclear Technology and Engineering Center have shown a trend of decreasing tritium concentrations. In general, tritium concentrations have declined in samples from wells within the contaminant plume and are stabilizing near the edges. Elevated levels measured in wells at the Radioactive Waste Management Complex have remained fairly constant.
Volatile Organic Compounds (VOCs)	Limited sampling for VOCs was conducted near TAN. Concentrations of cis-1,2-dicloroethene, trans-1,2-dichloroethene, tetrachloroethene, and trichloroethene exceeded drinking water standards.